TC400B

User Manual

January 26, 2007

Release 1.0

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Safety Certification and Agency Approvals

Safety:

UL 60950-1:2003, First Edition
CSA C22.2 No. 60950-1-03 1st Ed. April 1, 2003
IEC 60950-1:2001 First Edition
EN 60950
AS/NZS 60950

> **Note:** Finland, Norway and Sweden require that equipment using this product must be located in a Restricted Access Location (RAL).

Emissions:

47 CFR Part 15, Subpart B / 47 CFR Part 15, Subpart B, Class B
EN 55022:1998 Class B / EN 55022:1998 Class B Radiated and Conducted
EN 55024:1998 / IEC 61000

Immunity:

EN55024 ITE, EN61000

FCC Part 15

This device complies with part 15 of FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

Introduction to TC400B Documentation

This manual contains product information for the TC400B card. Be sure to refer to any supplementary documents or release notes that were shipped with your equipment. The manual is organized in the following manner:

Chapter/ Appendix	Title	Description
1	Overview	Identifies the features of your card. This chapter covers applications and uses of the TC400B in the real world.
2	Card Installation	Provides instructions for installing the card in your PC, acquiring correct drivers, and checking device compatibility.
3	Configuration	Provides examples for configuring options.
4	Questions and Answers	Explains resolutions to common problems and frequently asked questions pertaining to card installation and usage.
A	Specifications	Details card specifications.
B	Glossary and Acronyms	Defines terms related to this product.

Symbol Definitions

Caution statements indicate a condition where damage to the unit or its configuration could occur if operational procedures are not followed. To reduce the risk of damage or injury, follow all steps or procedures as instructed.

The ESD symbol indicates electrostatic sensitive devices. Observe precautions for handling devices. Wear a properly grounded electrostatic discharge (ESD) wrist strap while handling the device.

The Electrical Hazard Symbol indicates a possibility of electrical shock when operating this unit in certain situations. To reduce the risk of damage or injury, follow all steps or procedures as instructed.

Important Safety Instructions

User Cautions

Power Source.
The outlet should be installed near the equipment and be easily accessible.

Applying Power.
Use only the power cord, power supply, and/or batteries indicated in the manual. Do not dispose of batteries in a fire. The may explode. Check with local codes for special disposal instructions.

Installation
This card is for use only with compatible UL Listed computers that have Installation Instructions detailing installation of card cage accessories.

Servicing.
Do not attempt to service this card unless specifically instructed to do so. Do not attempt to remove the card from your equipment while power is present. Refer servicing to qualified service personnel.

Water and Moisture.
Do not spill liquids on this unit. Do not operate this equipment in a wet environment.

Heat.
Do not operate or store this product near heat sources such as radiators, air ducts, areas subject to direct, intense sunlight, or other products that produce heat.

Static Electricity.
To reduce the risk of damaging the unit or your equipment, do not attempt to open the enclosure or gain access to areas where you are not instructed to do so. Refer servicing to qualified service personnel.

Save these instructions for future reference.

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Chapter 1
Overview

The TC400B is a bundle of the half-length, low-profile PCI-2.2 compliant TC400P base card and the TC400M voice processing module. The TC400B is designed to handle, in dedicated DSP resources, the complex codec translations for highly compressed audio as would otherwise be processed by Asterisk in software.

Asterisk, in software and with Digium G.729a licensing, is capable of transforming the G.729a codec into other codecs for the purposes of call origination or termination, bridging disparate calls, or VoIP to TDM connectivity. These transformations in software are very expensive, in terms of MIPS, and require a substantial amount of CPU time to accomplish. The TC400B not only relieves the CPU of this duty, freeing it up to handle other tasks or to complete additional call processing; but also provides Asterisk with the capability of bridging G.723.1 compressed audio into other formats, a capability not previously possible.

The TC400P decompresses G.729a (8.0kbit) or G.723.1 (5.3kbit) into u-law or a-law; or, compresses u-law or a-law into G.729a (8.0kbit) or G.723.1 (5.3kbit). The TC400B is rated to handle up to 96 bi-directional G.729a transformations or 92 bi-directional G.723.1 transformations. The TC400B does not require additional licensing fees for the use of these codecs nor does it require the registration process associated with Digium's software-based G.729a codec licensing.

Features:

96 channels of bi-directional G.729a (8 Kbit) transcoding

or

92 channels of bi-directional G.723.1 (5.3Kbit) transcoding

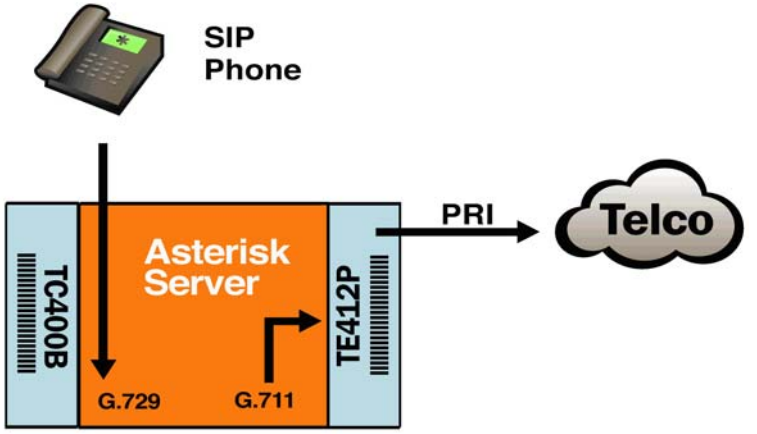

Figure 1: Sample Telco Application

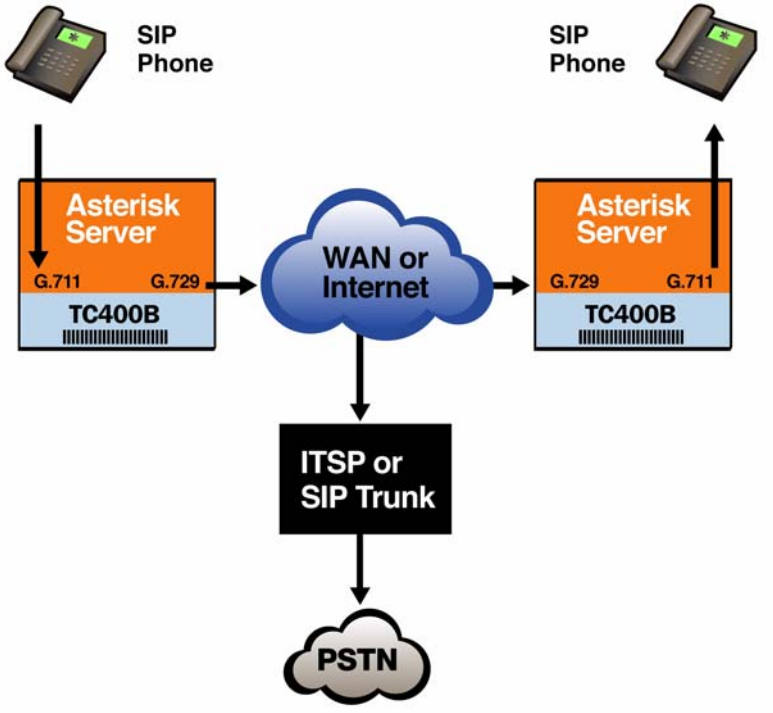

Figure 2: Sample Network Application

What is Asterisk?

Asterisk is the first Open Source PBX. Since it runs on Linux, it inherits all of the power and stability of the operating system. The name Asterisk is derived from the all-inclusive “wildcard” symbol in UNIX, because it is opening a wide range of opportunities for developers worldwide to create solutions which would otherwise be cost-prohibitive.

Asterisk allows you to create a PBX solution that rivals the features and functionality of traditional telephony switches. Current PBX solutions are expensive and proprietary. International companies are discovering that Asterisk is cost effective, low maintenance, and flexible enough to handle all of their voice and data networking. Combined with Digium hardware and a common PC, anyone can replace an existing switch or complement a PBX by adding VoIP, voicemail, conferencing, and many other capabilities. Asterisk will integrate with most standards-based IP telephone handsets and software. Analog phones and ADSI-screen phones are also supported.

Chapter 2
Card Installation

This chapter provides the following information:

- **Hardware Installation** on page 17
- **Software Installation** on page 18

When you unpack your card, carefully inspect it for any damage that may have occurred in shipment. If damage is suspected, file a claim with the carrier and contact your reseller where the card was purchased, or Digium Technical Support (+1.256.428.6161 or toll free at 1.877.LINUXME). Keep the original shipping container to use for future shipment or proof of damage during shipment.

> **Note:** Only qualified service personnel should install the card. Users should not attempt to perform this function themselves.

Figure 3: TC400B Card

Caution.
Only qualified service personnel should continue with hardware installation and configuration of the TC400B card. Users should not attempt to perform these functions themselves. This card is for use in Listed I.T.E. (information technology equipment) only.

The TC400B card is a 32-bit 33MHz card keyed for 3.3 or 5.0 volt operation and works in any PCI 2.2 (or higher) compliant slot.

Hardware Installation

1. Power down your computer and unplug it from its power source.
2. Attach a static strap to your wrist and open the case.
3. Remove the bracket place holder and insert the card into the PCI slot. See Figure 4.

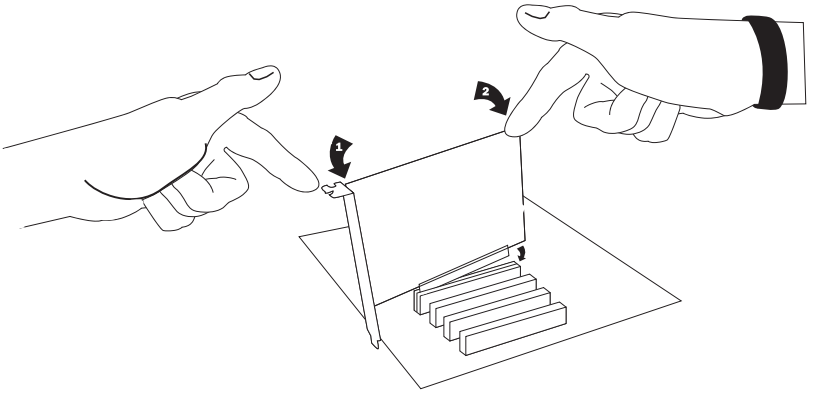

Figure 4: Insert the Card

4. Replace the cover to your computer.

Software Installation

If you are using the 1.2.x series of Asterisk and Zaptel, you will need Asterisk 1.2.15 or newer, and Zaptel 1.2.13 or newer. If you are using the 1.4.x series of Asterisk and Zaptel, you will need Asterisk 1.4.1 or newer and Zaptel 1.4.1 or newer. If you are using Asterisk Business Edition, you will need version B.1-4 or newer.

Asterisk/Zaptel 1.2 Installation

1. Go to www.asterisk.org and download zaptel version 1.2.13 or greater. Unpack the tarball.

```
#tar -zxvf zaptel-1.X.X.tar.gz
#cd zaptel-1.X.X
#make
#make install
```

2. Load Zaptel drivers into the kernel using the program modprobe. The appropriate driver for the TC400B card is **wctc4xxp**.

```
#modprobe wctc4xxp
```

3. Confirm that the card was started successfully by running the dmesg command. The screen output will be something similar to that shown in Figure 5. The text may vary slightly.

```
wctc4xxp: Wildcard TC400P+TC400M supporting 'g.729a / g.723.1 5.3kbps' with firmware version '56'
```

Figure 5: dmesg Output

4. Go to www.asterisk.org and download asterisk version 1.2.15 or greater.

```
#tar -zxvf asterisk-1.X.X.tar.gz
#cd asterisk-1.X.X
#make
#make install
```

Note: If the build fails, it may be because you are missing one of the build dependencies, the kernel source, or development tools. Feel free to contact your reseller where the card was purchased, or call Digium Technical Support (+1.256.428.6161 or toll free at 1.877.LINUXME) for assistance.

Complete instructions for installing Asterisk are available at www.asterisk.org.

Chapter 3
Configuration

At this time no zaptel.conf or zapata.conf changes are necessary to utilize this card. The ‘mode’ module parameter may be used to specify which complex codes are allowed.

- mode = mixed: This default option will enable 92 calls of G.729a or G.723.1 (5.3Kbit)
- mode = g729: This option will enable 96 calls of G.729a
- mode = g723: This default option will enable 92 calls of G.723.1 (5.3Kbit)

Testing Your configuration.

1. Start Asterisk by typing:
   ```
   #asterisk -vvvvc
   ```

2. Verify that the TC400B is registered with Asterisk by viewing the translation matrix.

```
*CLI> show transcoder
```

An example of the “show transcoder” is shown in Figure 6. The text shown may vary slightly.

```
0/0 encoders/decoders of 92 channels (G.729a / G.723.1 5.3 kbps) are in use.
```

Figure 6: Example show transcoder Result

Note: More detailed information is provided in the Asterisk User’s Manual. A copy may be requested by contacting Digium Technical Support (+1.256.428.6161 ot toll free at 1.877.LINUXME) or visiting the website at www.digium.com. You may also contact your distributor or reseller where the card was purchased for assistance.

Chapter 4
Questions and Answers

This chapter provides frequently asked questions as identified from Digium Technical Support and possible resolutions. Multiple resources are available to obtain more information about Asterisk and Digium products. These resources are listed on page 23.

Q: My card can’t seem to reach its full channel count, why?

A: Each call that uses the TC400B for transcoding requires two file handles. Increase your limit for open files.

Q: Asterisk issues errors such as "rtp.c: Unable to allocate socket: Too many open files." How can I solve this?

A: Each call that uses the TC400B for transcoding requires two file handles. Increase your limit for open files.

Q: Does my card take 1000 interrupts per second like my other Digium cards?

A: The TC400b only takes interrupts when it is in a active transcoding state, and will not pull interrupts when it is idling unlike other Digium hardware.

Where can I ask even more questions?

There are several places to inquire for more information about Asterisk Digium products:

1. Digium Technical Support (+1.256.428.6161) is available 7am-7pm Central Time, Monday - Friday.
2. Asterisk forums (forums.digium.com).
3. Asterisk users mailing list (lists.digium.com).
4. IRC channel **#asterisk** on (irc.freenode.net).

Appendix A
Specifications

This appendix provides specifications, required environmental conditions, and maximum power consumption for the TC400B card.

Physical.

Size:	4.69” × 2.52” × 0.63” (11.9 x 6.4 x 1.6 cm)
	PCB size, does not include the PCI bracket
Weight:	2.5 oz (70.9 gm)

Interfaces.

PCI Bus: 3.3V or 5V bus slot, half-length slot minimum size, 33MHz minimum bus speed, compliant with PCI 2.2 or greater.

Environment.

Temperature:	0 to 50° C (32 to 122° F) operation
	-20 to 65° C (4 to 149° F) storage
Humidity:	10 to 90% non-condensing

Supported Codecs:

G.729a 8.0Kbit
G.723.1 5.3kbit
μ-law (u-law)
α-law (a-law)

Hardware and Software Requirements.
400 Mhz Pentium III or better
512 MB RAM
Available PCI Slot (as described previously)
Linux 2.6 kernel

Table A-1: Maximum Power Consumption

Model	Power
TC400B 3.3V 5V	 0 Watts 4 Watts

Appendix B
Glossary and Acronyms

a-law

Mainly used in European telephone networks for the conversion between analog and digital signals in PCM applications. Similar to the North American mu-law standard. Refer to **G.711** on page 31 and **mu-law** on page 35.

ANSI *American National Standards Institute*

An organization which proposes and establishes standards for international communications.

asynchronous

Not synchronized; not timed to an outside clock source. Transmission is controlled by start bits at the beginning and stop bits at the end of each character. Asynchronous communications are often found in internet access and remote office applications.

attenuation

The dissipation of a transmitted signal's power as it travels over a wire.

bandwidth

The capacity to carry traffic. Higher bandwidth indicates the ability to transfer more data in a given time period.

bit

The smallest element of information in a digital system. A bit can be either a zero or a one.

bps *bits per second*

A measurement of transmission speed across a data connection.

broadband

Broadband transmission shares the bandwidth of a particular medium (copper or fiber optic) to integrate multiple signals. The channels take up different frequencies on the cable, integrating voice, data, and video over one line.

channel

A generic term for an individual data stream. Service providers can use multiplexing techniques to transmit multiple channels over a common medium.

Cat5

Category of Performance for wiring and cabling. Cat 5 cabling support applications up to 100 MHz.

Cat5E

Category of Performance for wiring and cabling. Category 5 Enhanced wiring supports signal rates up to 100 MHz but adheres to stricter quality specifications.

CLEC *competitive local exchange carrier*

A term for telephone companies established after the Telecommunications Act of 1996 deregulated the LECs. CLECs compete with ILECs to offer local service. See also *LEC* and *ILEC*.

CO *central office*

The CO houses local switching equipment. All local access lines in a particular geographic area terminate at this facility (which is usually owned and operated by an ILEC).

CPE *customer premises equipment*

Terminal equipment which is connected to the telecommunications network and which resides within the home or office of the customer. This includes telephones, modems, terminals, routers, and television set-top boxes.

DS0 *Digital Signal, Level 0*

A voice grade channel of 64 Kbps. The worldwide standard speed for digitizing voice conversation using PCM (Pulse Code Modulation).

DS1 *Digital Signal, Level 1*

1.544 Mbps in North America (T1) and Japan (J1) -up to 24 voice channels (DS0s), 2.048 Mbps in Europe (E1) - up to 32 voice channels (DS0s). DS1/T1/E1 lines are part of the PSTN.

DS3 *Digital Signal, Level 3*

T3 in North America and Japan, E3 in Europe. Up to 672 voice channels (DS0s). DS3/T3/E3 lines are not part of the PSTN

DTMF *Dual Tone Multi-Frequency*

Push-button or touch tone dialing.

E1

The European equivalent of North American T1, transmits data at 2.048 Mbps, up to 32 voice channels (DS0s).

E3

The European equivalent of North American T3, transmits data at 34.368 Mbps, up to 512 voice channels (DS0s). Equivalent to 16 E1 lines.

EMI *Electromagnetic Interference*

Unwanted electrical noise present on a power line

full duplex

Data transmission in two directions simultaneously.

FXO *Foreign Exchange Office*

Receives the ringing voltage from an FXS device. Outside lines are connected to the FXO port on your TC400B card.

FXS *Foreign Exchange Station*

Initiates and sends ringing voltage. Phones are connected to the FXS ports on the TC400B card.

G.711

The International Telecommunications Union recommendation for an algorithm designed to transmit and receive mulaw PCM voice and A-law at digital bit rate 64 Kbps. This algorithm is used for digital telephone sets on digital PBX.

G.723.1

The Telecommunication Standardization Sector (ITU-T) algorithm for compressed audio over telephone lines at 6.3 or 5.3 Kbps.

G.729a

An International Telecommunications Union standard for voice algorithm for encoding/decoding at 8 Kbps.

H.323

An International Telecommunications Union standard for multimedia communications over packet-based networks.

IAX *Inter-Asterisk eXchange*

A VoIP protocol used by Asterisk. It is used to enable VoIP connections between Asterisk servers, and between servers and clients that also use the IAX protocol.

iLBC *internet Low Bitrate Codec*

A free speech codec used for voice over IP. It is designed for narrow band speech with a payload bitrate of 13.33 kbps (frame length = 30ms) and 15.2 kbps (frame length = 20 ms).

ILEC *incumbent local exchange carrier*

The LECs that were the original carriers in the market prior to the entry of competition and therefore have the dominant position in the market.

interface

A point of contact between two systems, networks, or devices.

ISO *International Standards Organization*

LED *light-emitting diode*

Linux

A robust, feature-packed open source operating system based on Unix that remains freely available on the internet. It boasts dependability and offers a wide range of compatibility with hardware and software. Asterisk is supported exclusively on Linux.

loopback

A state in which the transmit signal is reversed back as the receive signal, typically by a far end network element.

MGCP *Media Gateway Control Protocol*

multiplexing

Transmitting multiple signals over a single line or channel. FDM (frequency division multiplexing) and TDM (time division multiplexing) are the two most common methods. FDM separates signals by dividing the data onto different carrier frequencies, and TDM separates signals by interleaving bits one after the other.

MUX *multiplexer*

A device which transmits multiple signals over a single communications line or channel. See multiplexing.

PBX *private branch exchange*

A smaller version of a phone company's large central switching office. Example: Asterisk.

PCI *peripheral component interconnect*

A standard bus used in most computers to connect peripheral devices.

POP *point of presence*

The physical connection point between a network and a telephone network. A POP is usually a network node serving as the equivalent of a CO to a network service provider or an interexchange carrier.

POTS *plain old telephone service*

Standard phone service over the public switched telephone network (PSTN). This service provides analog bandwidth of less than 4 kHz.

PPP *point-to-point protocol*

Type of communications link that connects a single device to another single device, such as a remote terminal to a host computer.

PSTN *public switched telephone network*

A communications network which uses telephones to establish connections between two points. Also referred to as the dial network.

QoS *quality of service*

A measure of telephone service, as specified by the Public Service Commission.

RJ11

A six-pin jack typically used for connecting telephones, modems, and fax machines in residential and business settings to PBX or the local telephone CO.

SIP *Session Initiation Protocol*

An IETF standard for setting up sessions between one or more clients. It is currently the leading signaling protocol for Voice over IP, gradually replacing H.323.

T1

A dedicated digital carrier facility which transmits up to 24 voice channels (DS0s) and transmits data at 1.544 Mbps. Commonly used to carry traffic to and from private business networks and ISPs.

T3

A dedicated digital carrier facility which consists of 28 T1 lines and transmits data at 44.736 Mbps. Equivalent to 672 voice channels (DS0s).

TDM *time division multiplexer*

A device that supports simultaneous transmission of multiple data streams into a single high-speed data stream. TDM separates signals by interleaving bits one after the other.

telco

A generic name which refers to the telephone companies throughout the world, including RBOCs, LECs, and PTTs.

tip and ring

The standard termination on the two conductors of a telephone circuit; named after the physical appearance of the contact areas on the jack plug.

twisted pair

Two copper wires commonly used for telephony and data communications. The wires are wrapped loosely around each other to minimize radio frequency interference or interference from other pairs in the same bundle.

u-law

Also known as mu law, is the PCM quasi-logarithmic curve. It is the 64 Kbps standard North America voice amplitude sample used for encoding/decoding.

V *volts*

VoIP *Voice over IP*

Technology used for transmitting voice traffic over a data network using the Internet Protocol.

Zaptel (Zap)

Zapata Telephony Project dedicated to implementing a reasonable and affordable Computer Telephony platform into the world marketplace.